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National versus region-specific causes of regional unemployment: An Input-output based approach

1. Introduction

It is important to assess to what extent regional unemployment movements are driven by local forces as opposed to those changes originating rather from decisions and actions made at the national level, and this is well recognized in the economic literature. Since and , the first who tried to get an answer to the question under consideration by regressing regional unemployment rates on the national counterparts, the estimation of the relation between regional and national unemployment has become a standard vehicle in differentiating between national and region-specific factors that determine the regional unemployment rate. Over the years the approach originally proposed by the above-mentioned authors has been extended in a substantial manner. One of the last modifications is that of who pointed to alternative methods for estimating the parameters of the main equation which are, in contrast to those previously applied, unbiased.

It is characteristic of the above-mentioned approaches that they all require rather long sequences of data, and the accessibility of such data may appear to be a serious problem in the case of economies like that of Poland where the researcher is continuously forced to deal with data scarcity. Another reason that basically precludes employing a time series approach is that even where a long enough

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series of data would be readily available from the regularly published statistics, their comparability is usually questionable due to frequent changes to the rules on which the respective statistics are calculated. This is particularly true for countries in a transition process when adequate procedures for collecting and elaborating economic information have yet to be established.

Keeping in mind what has been said above, there are obvious motives to develop a method that, being insensitive to data scarcity and changes in ongoing rules, allows us to examine whether the unemployment recorded in a given region depends on region-specific rather than national factors. The approach that meets these requirements relies on a comparison between the real and the predicted unemployment generated by means of a method which assumes that the crucial characteristics remain the same in the case of all regions and are identical with those of national ones. Data from Poland are used in order to illustrate the performance of the suggested method in practice. The period over which the technique has been tested covers four consecutive years, with 2000 as the initial year. Although the scope of this study is mainly methodological, it also provides some economically and practically interesting results that deserve to be highlighted. Two regions, namely Centralny and Wschodni, out of the six considered, emerged as two extremes. Both regions are characterized by the relatively large extent to which the regional unemployment is determined by region-specific factors, but while the latter seems to take advantage of it, in the case of the former the reverse is true (without knowledge of how such an advantage is defined under this study the last statement would be rather surprising or even confusing).

The plan of the paper is as follows. In the next section a description of the proposed method is presented along with some remarks concerning the data used and the required adjustment of it. Section 3 discusses the empirical results while the last section concludes the paper and formulates some suggestions about possible directions of further research.

2. Investigation desing

2.1. Methodlogy

There exists, of course, a vast body of literature devoted to the determination of factors that shape regional unemployment rates. The majority of them underline the fundamental role of restructuring of labour resources as one of the most important elements in explaining the behaviour of regional unemployment rates. Such a restructuring is typically associated with changes in industrial structure or in other industrial characteristics which not being related to shifts in the shares of industries

still affect labour demand. The corresponding evidence can be found in many earlier empirical studies (see e.g.). Also in the most recent work () the essential role of restructuring in the determination of regional unemployment has been emphasized, although the positive relationship postulated by the earlier contributors between restructuring and regional unemployment rates is not necessarily still valid.

Assuming $\mathbf{Z}_{(k \times n)}$ and $\mathbf{W}_{(k \times m)}$ to be matrices which contain the total national employment presented in an occupation-by-industry and occupation-by-educational attainment form. Given the number of employees, R_j , required to obtain the total output of j th industry, x_j , it is possible to calculate the national distribution of occupations within each individual sector (Ψ) and the corresponding distribution of educational attainment for each individual occupation (Γ):

$$\Psi = [\psi_{ij}] = \mathbf{Z}(\hat{\mathbf{v}}\hat{\mathbf{x}})^{-1}, \quad (1)$$

$$\Gamma = [\gamma_{ip}] = \hat{\mathbf{s}}^{-1}\mathbf{W}, \quad (2)$$

where $\mathbf{v}$ is the vector of ratios of the employees to the sectoral total output ($v_j = R_j/x_j$), $\mathbf{s}$ stands for the vector containing the column-sums of $\mathbf{W}$, and the circumflex denotes the diagonal matrix formed from the vector.

Letting R^r and U^r denote respectively employment and unemployment recorded in a certain region (r), the predicted unemployment, $\tilde{U}^r$, can be obtained as follows:

$$\tilde{U}^r = U^r + R^r - E(R^r | \Psi, \Gamma, \mathbf{v}), \quad (3)$$

where $E(\cdot)$ means a mathematical expectation operator.

Thus, the predicted unemployment ($\tilde{U}^r$) represents the level of unemployment that would be reached in a certain region (r) if the distribution of occupations within each individual sector, the distribution of educational attainment for each individual occupation, and the ratios of the employees to the sectoral total output in the region under consideration exactly coincide with the corresponding national counterparts. It can, therefore, be stated that any equality of the real and the predicted unemployment indicates no region-specific forces affecting the regional level of unemployment. In contradistinction to this, the greater the difference between the above-mentioned variables, then the larger the extent to which regional unemployment is determined by region-specific factors.

The last issue we have to address here is that of how the expected regional employment can be obtained. It is clear from what has been said above that the method we employ for this purpose should base the forecasts on the national distributions of occupations and educational attainment as well as the national

ratio of the employees over the sectoral total output. Taking this into account a modified version of the technique originally proposed by to estimate demand for educational attainment has been chosen. The modification relies on replacing the regional employment vector by the product of $\mathbf{v}$ and the regional total output vector ($\mathbf{x}^r$). In this way the regionally differentiated ratios of employees are treated as a region-specific factor that wedges between the national and regional unemployment rates.

In the first step, combining the matrices and , a block-matrix ($\mathbf{D}$) is derived:

$$\mathbf{D} = \begin{bmatrix} \Psi_{11}\gamma_{11} & \cdots & \Psi_{11}\gamma_{1m} & | & \Psi_{12}\gamma_{11} & \cdots & \Psi_{12}\gamma_{1m} & | & \cdots & | & \Psi_{1n}\gamma_{11} & \cdots & \Psi_{1n}\gamma_{1m} \\ \vdots & & \ddots & & \vdots & & \ddots & & & & \vdots & & \ddots \\ \Psi_{k1}\gamma_{k1} & \cdots & \Psi_{k1}\gamma_{km} & | & \Psi_{k2}\gamma_{k1} & \cdots & \Psi_{k2}\gamma_{km} & | & \cdots & | & \Psi_{kn}\gamma_{k1} & \cdots & \Psi_{kn}\gamma_{km} \end{bmatrix},$$

where each of the n blocks represents an individual industry and for the j th industry the corresponding block of it ($\mathbf{D}^{[j]}$) can be obtained by multiplying the diagonal matrix formed from the j th column of matrix Ψ by Γ :

$$\mathbf{D}^{[j]} = \hat{\Psi}^j \Gamma \quad (4)$$

and the regional counterpart of the matrix $\mathbf{Z}$ can be derived as follows:

$$\mathbf{Z}^r = \sum_{j=1}^n v_j x_j^r \mathbf{D}^{[j]} \mathbf{e}, \quad (5)$$

where $\mathbf{e}$ stands for a summation vector containing ones.

Summing the elements of $\mathbf{Z}^r$ across occupations gives the expected regional employment by sector.

2.2. Data

Although the examination covers a four-year-period starting at 2000, there was only one survey carried out by the Central Statistical Office (CSO) that provided us with the distribution of occupations within each individual sector and the distribution of educational attainment for each individual occupation at the national level. The survey forming the basis for this investigation concerns the economic activities of people living within the borders of Poland at the middle of 2002 but the resultant publication was released just at the end of 2003. Therefore, it had to be assumed that both of the distributions mentioned above remained stable over the analysed period. The applied division of the economy into sectors followed the sections of NACE. As regards the occupations and the education le-

vels, the former were grouped according to the Classification of Occupations and Speciality (COS) introduced at the end of 2002 while the latter range from people having at least doctoral and master's degree to those of primary and incomplete primary education (i.e. eight different levels). When regional data are required, these are taken from the database developed by the Bank of Regional Data (BRD). From this database the total employment by sector for six main regions in Poland (corresponding to the one-digit Geopolitical Entity Classification) was selected.

Minor adjustments of the original data had to be made at the very beginning of the analysis to ensure the complete consistency of the data at the national level with those concerning the regions. The necessary exclusion of the last two occupation categories used within the CSO's survey, namely "Employed in military" and "Undetermined occupation", yields controlling sums of employment by sector and of employment by levels of educational attainment which are not equal to one another. For this reason, the RAS method was employed here in order to restore the balance.

3. Empirical results

From one can easily realize that the difference between the real regional unemployment and the expected unemployment amounts to deducting the actual employment in the region under consideration from the expected employment obtained by means of the method proposed in the previous section. It is, therefore, entirely sufficient to focus on the difference between the expected and actual employment without involving the number of people that are unemployed. It is probably helpful to recall here that an excess of expected employment over that observed indicates a positive gap between the actual unemployment and the predicted unemployment. On the other hand, if the expected employment should be below that recorded in reality, this means that actual unemployment is lower than expected while assuming the distributions of occupations and educational attainment, and the ratio of the employees over the sectoral total output to be all identical with their national counterparts.

Keeping in mind what has been said above, the actual and the expected employment by sector for the regions under consideration over the analyzed period were tabulated (see Tables 1–6).

The region whose results in terms of the employment gap deserve to be discussed first is Centralny. This region comprises two provinces, namely Mazowieckie and Łódzkie. The most striking finding, not repeated by any other region under consideration, is that all the employment gaps are of a positive sign with the single exception of sector A (Agriculture, hunting and forestry) in 2002 when the real em-

ployment exceeded that expected by almost four thousand people. This means that over the whole analysed period the recorded unemployment in the region surpassed the expected level. In terms of the extent to which the regional unemployment is determined by region-specific forces, it can also be concluded that Centralny was one of the regions with the largest proportion of region-specific factors in shaping unemployment and that this entails unfavourable effects to the region.

Focusing on industries as a point of departure, one can find that sector I (Transport, storage and communication) was ranked first with respect to the gap's magnitude. Note that it peaked at over a hundred thousand people in 2001, and then started to fall to the level of 104.25 thousand people in 2003. The remaining three top sectors are E (Electricity, gas and water supply), G (Wholesale and retail trade), and O+P (Other community, social and personal service activities). The most changeable sector in Centralny is sector A whose result ranges from the above-mentioned -3.7 thousand people in 2002 to over 63 thousand people in 2001 (the latter appeared to be large enough for this sector to be ranked second in 2001).

Table 1

Actual versus expected employment in „Centralny” across sectors

	Actual employment				Expected employment			
	2000	2001	2002	2003	2000	2001	2002	2003
A	827.0	828.1	525.4	523.2	832.5	891.5	521.7	526.0
B	0.2	0.1	0.2	0.2	0.3	0.3	0.2	0.2
C	8.2	7.2	12.2	11.8	12.7	11.3	12.8	13.4
D	556.9	598.4	547.1	526.9	588.7	599.7	558.0	544.8
E	50.7	41.4	49.6	48.0	92.7	82.0	99.3	98.8
F	188.9	197.5	172.6	159.2	204.5	212.0	202.0	181.0
G	485.5	546.4	518.9	510.1	519.9	599.2	568.8	552.5
H	42.0	43.2	45.3	46.8	53.6	56.3	55.1	55.2
I	183.5	171.5	187.2	187.2	271.9	282.7	293.7	291.5
J	101.6	89.5	84.4	79.4	140.5	136.4	102.3	100.4
K	251.6	275.7	281.2	294.4	271.8	301.3	309.8	337.9
L	114.0	92.3	127.4	128.2	116.0	94.3	131.0	133.3
M	190.9	173.0	188.6	198.3	208.0	192.3	206.9	213.2
L	198.0	175.1	192.9	172.9	217.0	188.1	195.7	178.0
O+P	152.8	156.6	81.0	121.2	191.8	195.0	120.0	152.3

The employment is measured in thousands of people. See Appendix A to take the NACE section definitions.

Table 2

Actual versus expected employment in „Południowy” across sectors

	Actual employment				Expected employment			
	2000	2001	2002	2003	2000	2001	2002	2003
A	670.0	670.2	345.7	344.9	403.7	346.4	207.0	215.9
B	0.6	0.5	0.3	0.3	0.3	0.3	0.3	0.2
C	175.1	139.6	148.6	143.6	135.3	111.9	122.5	114.7
D	561.0	559.8	519.2	511.2	604.9	585.9	548.3	549.8
E	57.4	46.6	57.0	55.0	52.8	41.9	49.9	45.7
F	207.0	209.1	184.8	169.6	191.4	193.0	162.9	152.2
G	434.8	477.3	456.0	454.2	443.2	483.6	460.7	465.8
H	48.2	52.6	52.8	53.3	45.6	49.1	48.5	49.2
I	170.0	152.8	155.5	155.7	150.3	126.9	133.1	132.7
J	55.8	52.3	40.8	38.1	52.5	44.5	39.1	35.5
K	182.0	191.9	204.7	214.9	175.7	189.0	201.6	210.9
L	82.6	67.0	90.1	90.6	79.4	64.8	88.6	91.2
M	185.3	164.3	186.3	195.9	184.4	167.9	182.7	191.5
L	208.8	185.7	195.3	177.2	194.3	170.3	179.9	165.3
O+P	90.6	96.6	70.0	84.4	76.9	84.2	54.8	69.9

The employment is measured in thousands of people. See Appendix A to take the NACE section definitions.

Table 3

Actual versus expected employment in „Wschodni” across sectors

	Actual employment				Expected employment			
	2000	2001	2002	2003	2000	2001	2002	2003
A	1317.3	1317.6	769.0	768.5	854.9	838.7	497.5	515.6
B	0.6	0.6	0.4	0.5	0.7	0.8	0.7	0.7
C	14.2	11.7	8.5	7.9	19.0	10.6	11.9	12.8
D	390.6	377.9	360.9	357.4	326.3	330.3	305.9	301.4
E	37.7	31.4	40.4	39.0	23.0	18.4	24.1	21.9
F	116.2	116.7	103.9	95.3	111.6	119.0	103.2	98.5
G	282.8	310.3	299.3	300.7	262.5	288.7	276.7	280.7

Table 3 cont.

Actual versus expected employment in „Wschodni” across sectors

	Actual employment				Expected employment			
	2000	2001	2002	2003	2000	2001	2002	2003
H	22.3	25.0	22.7	23.5	21.3	24.2	24.9	26.0
I	122.7	109.7	109.7	107.7	94.0	78.5	74.9	75.9
J	44.2	40.5	30.1	29.0	26.7	24.5	22.7	21.0
K	82.2	91.5	101.3	109.8	82.4	90.3	97.5	100.4
L	77.6	63.3	87.9	87.9	78.6	63.5	85.1	86.1
M	171.0	163.1	159.1	165.3	150.8	137.6	147.9	154.4
L	171.2	150.2	151.4	139.8	153.5	138.6	140.4	126.3
O+P	52.5	59.2	39.5	45.3	42.4	50.6	31.3	40.3

The employment is measured in thousands of people. See Appendix A to take the NACE section definitions.

Scrutinizing Table 1 also shows which of the sectors are characterized by a predominant role of national factors in determining regional unemployment, as shown by insignificant employment gaps. Such sectors include B (Fishing), C (Mining and quarrying), and L (Public administration and defence). In the case of these sectors the differences between the actual and the expected unemployment were less than or slightly above five thousand people. Setting aside the result in 2001, sector A should also be classified as belonging to this group.

The Południowy region shares its basic patterns with Wschodni though in the case of the latter the same processes appear to be more intensive when measured by the average employment gap (see Tables 2 and 3). Therefore, these regions will be jointly discussed. The first of them, Południowy, is composed of two provinces: Małopolskie and Śląskie, while Wschodni consists of three provinces located in the eastern part of Poland, namely Lubelskie, Podkarpackie and Świętokrzyskie. A common feature of the regions is, first and foremost, that they both were dominated by an excess of expected unemployment. What can be concluded from this? A substantial difference between actual and expected unemployment indicates that the relatively large extent to which regional unemployment is driven by region-specific factors. From the fact that these differences mostly have a negative sign one can, on the other hand, draw the inference that these regions, unlike Centralny which has been previously presented, take advantage of their individuality in the sense that such region-specific forces strengthen any stimulus arising from the national level. For example, given that the ratios of employment to total output for a given region are higher than their national equivalents, any additional increase in

total output will generate, on average, heavier rises of employment and, assuming no change on the supply side of the labour market, lead to greater reductions of unemployment in the region as compared to the economy as a whole. This is just what we term above as a benefit from region's individuality.

The favourable consequences of the last conclusion for both the regions do not necessarily prove so salutary when we realise that sector A accounts for approximately 64 and 67 percent of the total negative gap in Południowy and Wschodni, respectively. Furthermore, one of the most important sectors in terms of their contribution to the total output of the former, namely Manufacturing (D), experienced at the same time a relatively sizable positive gap of almost 35 thousand people, on average over the entire analysed period. Another sector which also experienced a quite high positive difference between expected and observed employment (on average about 8 thousand people over a four-year-period), despite the region as a whole being classified as a beneficiary of its individuality, was sector G.

Table 4

Actual versus expected employment in „Północno-zachodni” across sectors

	Actual employment				Expected employment			
	2000	2001	2002	2003	2000	2001	2002	2003
A	467.4	465.5	295.7	292.7	807.7	847.5	492.5	480.2
B	4.3	4.0	2.5	2.2	4.2	3.2	2.0	1.9
C	12.4	10.8	11.0	10.6	14.1	12.5	14.0	14.7
D	483.7	487.2	458.9	453.8	447.9	454.9	420.0	415.7
E	35.3	29.7	36.0	34.8	28.4	22.8	26.2	25.4
F	135.8	140.8	124.8	114.9	143.4	139.9	122.1	112.0
G	340.0	374.5	351.9	350.8	335.6	361.0	338.2	332.8
H	35.0	38.3	41.0	40.9	33.8	36.4	36.9	37.7
I	143.4	128.6	123.9	120.8	131.9	111.8	111.0	108.5
J	48.9	44.6	33.9	31.7	40.3	34.5	28.8	27.0
K	123.9	140.4	146.7	153.9	122.7	131.7	139.7	143.1
L	73.8	60.6	82.5	84.8	75.7	61.3	83.1	83.2
M	141.1	127.2	140.3	147.4	145.5	129.9	143.2	149.0
L	145.5	132.3	132.0	119.8	154.1	139.6	142.5	129.0
O+P	70.3	76.8	49.9	60.6	59.2	63.7	40.7	51.7

The employment is measured in thousands of people. See Appendix A to take the NACE section definitions.

Table 5
Actual versus expected employment in „Południowo-zachodni” across sectors

	Actual employment				Expected employment			
	2000	2001	2002	2003	2000	2001	2002	2003
A	266.4	265.6	139.6	138.3	375.5	355.8	212.3	192.2
B	0.5	0.4	0.4	0.4	0.3	0.3	0.5	0.4
C	26.8	22.0	30.2	29.2	53.3	44.5	47.8	46.3
D	280.4	273.3	251.4	249.4	311.2	318.3	304.2	293.8
E	28.2	23.1	27.7	26.9	27.5	20.6	24.0	23.5
F	93.8	94.8	79.8	72.2	90.5	90.4	76.4	67.8
G	194.3	216.5	203.3	204.2	192.0	209.1	195.4	197.3
H	23.3	25.6	23.0	22.8	20.8	22.7	22.5	23.0
I	86.2	77.1	75.7	74.6	77.5	63.5	60.0	58.1
J	32.3	29.2	23.3	22.2	32.2	25.3	21.0	19.1
K	89.5	96.3	104.4	107.9	78.9	87.0	91.5	94.9
L	48.9	39.7	53.2	54.6	48.6	39.9	54.4	54.5
M	94.2	83.5	91.2	94.4	95.8	85.4	90.8	94.4
L	112.7	101.1	97.4	87.5	113.0	103.0	101.1	91.8
O+P	41.2	44.1	31.1	35.6	38.8	43.3	27.8	35.1

The employment is measured in thousands of people. See Appendix A to take the NACE section definitions.

The second considered region, Wschodni, seems to be far more homogeneous with regard to the sign of the differences because employment gaps having a positive sign are rare, and more importantly, even when they occurred over the analysed period the amount of each difference is close to zero apart from two cases when it attained almost 5 thousand people.

The remaining regions are placed somewhere on a continuum bounded on one side by the case of Centralny and the case of Południowy and Wschodni on the other. All of them are characterized by rather a erratic employment gap with respect to both sign and size across sectors as well as time dimension (see Tables 4–6). It should, however, be stressed that in all these regions the differences between the expected and actual employment recorded for sector A were positive and relatively high when compared to those experienced by other sectors under consideration. The reader may draw further conclusions in analogy to those which have been formulated above.

Table 6
Actual versus expected employment in „Północny” across sectors

	Actual employment				Expected employment			
	2000	2001	2002	2003	2000	2001	2002	2003
A	398.5	397.9	254.6	253.2	672.2	665.2	399.0	390.9
B	3.7	3.6	2.9	3.1	3.7	4.2	3.0	3.1
C	2.5	2.6	2.5	2.5	4.9	3.4	4.0	3.8
D	416.1	411.0	392.8	383.7	409.9	418.5	393.8	376.9
E	32.2	27.2	31.8	30.9	17.1	13.6	19.1	19.3
F	116.4	119.3	103.9	94.0	116.5	123.9	103.2	93.5
G	276.4	307.3	287.9	288.2	260.8	290.7	277.7	279.0
H	31.3	34.7	34.1	33.9	26.9	30.5	30.9	30.2
I	126.2	113.0	113.0	109.1	106.6	89.6	92.3	88.6
J	42.5	38.8	30.7	30.0	33.2	29.5	29.3	27.5
K	105.7	117.7	124.1	131.4	103.4	114.2	122.2	125.0
L	70.1	56.9	76.1	78.2	68.8	56.2	75.0	75.9
M	137.7	123.0	136.4	139.3	135.6	120.9	130.4	138.2
L	135.9	120.5	121.1	112.1	140.0	125.2	130.4	119.0
O+P	59.2	64.8	41.6	50.9	57.6	61.2	38.6	48.6

The employment is measured in thousands of people. See Appendix A to take the NACE section definitions.

To characterize more formally each of the regions in terms of proportions of national and region-specific forces acting in the determination of regional unemployment two different measures, namely mean percentage error (MPE) and mean absolute percentage error (MAPE) are proposed which being based on the standard definition of average errors gain, however, an extra interpretation in the context of regionally differentiated sources of unemployment. These measures are defined as follows:

$$\text{MPE}_t^r = \frac{\sum_{j=1}^n (\hat{R}_{j,t}^r - R_{j,t}^r)}{\sum_{j=1}^n R_{j,t}^r} \cdot 100\% \quad (6)$$

$$\text{MAPE}_t^r = \frac{\sum_{j=1}^n |\hat{R}_{j,t}^r - R_{j,t}^r|}{\sum_{j=1}^n R_{j,t}^r} \cdot 100\% \quad (7)$$

Both the formulae involve the differences between the expected employment in a given region and the actual employment and when they are near to zero it can be concluded that in the region under consideration national factors play the superior role in shaping the regional unemployment. On the other hand, the greater the values taken by the measurements (in the case of the former in an absolute sense), the larger the extent to which regional unemployment is determined by region-specific factors. Comparing the values of and for the same region in the same period also provides valuable information. While their approximate equality (in an absolute sense) means that employment gaps maintain the same sign across industries, a significantly higher value of the latter as compared to that of the former indicates that the sign of the difference between the expected and the observed employment varies across industries.

Figures 1 and 2 portray MPE and MAPE for all the considered regions.

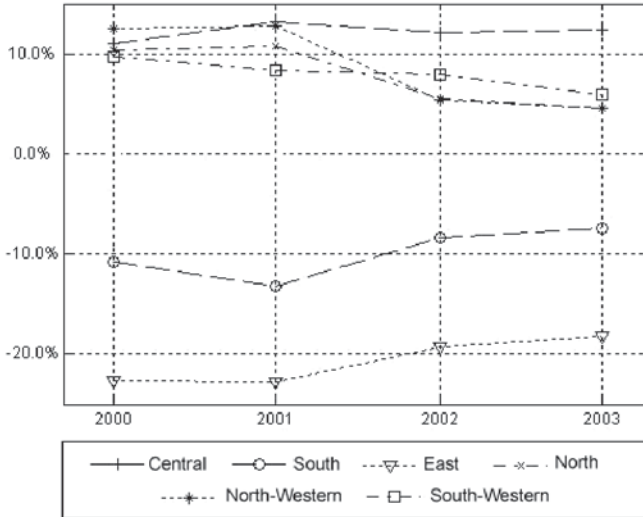


Fig. 1. Mean percentage error for six regions over the analyzed period

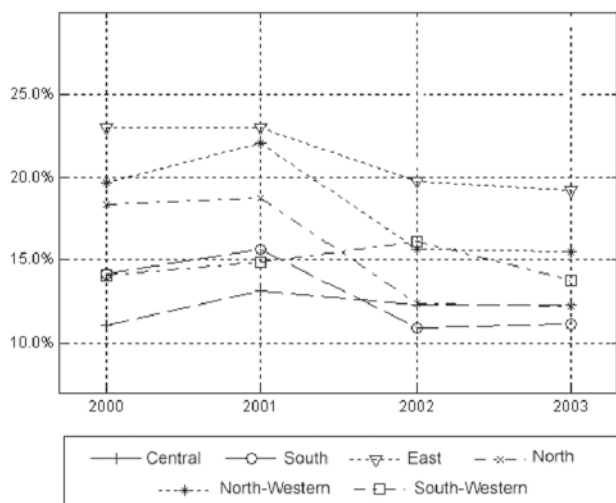


Fig. 2. Mean absolute percentage error for six regions over the analyzed period

The values of the measurements proposed above in order to shed light on the proportions in which national and region-specific forces combine to determine regional unemployment basically confirm what has been stated previously. The two extreme cases are Centralny where average MPE amounts to over 12 percent, and Wschodni whose MPE ranges from -18.3 to -22.8 percent over the considered period (with an average equal to -20.7 percent). The latter is followed by Południowy which scored approximately 10 percentage points below (in an absolute sense) Wschodni. A further look at the figures reveals however a fact that previously has not been so apparent. While the values of MPE and MAPE for Centralny and Wschodni are almost identical (for Wschodni in an absolute sense, of course), for Południowy both the measures break up in the course of time, indicating that the region's performance is much more industrially differentiated. Regarding the remaining three regions included in the study one can find that MPE overcomes the 10% interval in none of them. Furthermore, for all these regions it can be seen that MAPE deviates substantially from the value of MPE.

6. Conclusions

Data scarcity, especially in the developing countries, constitutes the main obstacle which the researcher encounters when employing the traditional methods

of examining the extent to which unemployment in a given region is driven by region-specific forces as opposed to those of national origin. The main purpose of this study has been, therefore, to overcome this difficulty by developing an alternative technique that should, first and foremost, be less data demanding than the traditional solutions. A technique based on an input-output framework has been proposed that requires only relatively readily accessible data from the national and regional statistics, concerning, in the most extreme case, even a single year.

Based on the data from Poland covering a four-year-period, with 2000 as an initial year, the technique seems to prove its usefulness as a tool that is able to provide the researcher with, at least, a rough impression about the proportions in which region-specific and national factors combine to determine regional unemployment.

It should be, however, stressed that many questions still remain unanswered. Firstly, further research is needed to identify critical values of MPE and MAPE so that a region's position on a continuum with no national forces at one end and no region-specific forces at the other can be better characterized. Secondly, it appears to be particularly interesting to break down the total effect into its components and answer to which extent a particular result is caused by, for example, a deviation of the regional distribution of educational attainment from its national equivalent. To attain this goal, however, much more detailed statistics at the regional level will be indeed needed, which means that we again have to face the problem that motivated this study, namely data scarcity.

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Appendix A

The sections of the NACE classification

Section	Description
A	Agriculture, hunting and forestry
B	Fishing
C	Mining and quarrying
D	Manufacturing
E	Electricity, gas and water supply
F	Construction
G	Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods
H	Hotels and restaurants
I	Transport, storage and communication
J	Financial intermediation
K	Real estate, renting and business activities
L	Public administration and defence
M	Education
L	Health and social work
O+P	Other community, social, personal service activities